Sample Questions for Chem 002 Final FS08

1. MSDS (the rest listed on review):

a. Proper attire –

b. Acid Spill –

c. Bunsen Burners –

d. Phenolphthalein –

e. Types of radiation (listed below) are stopped by what type of material?

alpha –

beta –

gamma –

neutron –

2. Radioactive Decay:

a. Balance the following radioactive decay equations:

$$^{222}_{86}Rn \rightarrow \_\_\_\_\_\_ + ^{4}_{2}He$$

$$^{234}_{90}Th \rightarrow \_\_\_\_\_\_ + ^{0}_{-1}e + \textit{anti}\text{-}\upsilon$$

b. Determine the specific decay constant, initial activity and half-life of a radioactive isotope. Given

Time, minutes	**Counts/Min**	**ln (Counts/Min)**
0		
2	14472	
3	14328	
4	14248	
5	14095	
6	13920	
10	13359	

1. Determine the specific decay constant, k, for this radioactive decay.

2. Determine the initial activity, A_o.

3. Determine the half-life.

3. Heat of Neutralization:

A reaction of 100mL of 1.35M HCl and 100mL of 1.76M NaOH is monitored and the following temperatures were recorded: starting temperature = 24.6 ^oC; and final temperature = 38.8 ^oC. Calculate the ΔH of this reaction.

Given: **C_p of solution (J/K) = 4.13*Volume of solution in mL**
C_p of calorimeter (J/K) = 50
ΔH = (ΔT*total C_p)/(mols of solution)

a. Determine the change in temperature for the system.

b. Determine the C_p of the solution (J/K).

c. Determine the total C_p of the system.

d. Determine the number of moles of the acid and the base. Which is the limiting reagent?

e. Determine the change in enthalpy, ΔH, for the reaction.

f. If heat transfers from the system (solute) to the surroundings (solvent), then ΔH is negative ($\Delta H < 0$), and the reaction is defined as (endothermic / exothermic) and the temperature of the solvent will go (up / down).

g. If heat transfers from the surroundings (solvent) to the system (solute), then ΔH is positive ($\Delta H > 0$), and the reaction is defined as (endothermic / exothermic) and the temperature of the solvent will go (up / down).

h. The heat of neutralization experiment was an (endothermic / exothermic) reaction .

i. The heat of fusion experiment was an (endothermic / exothermic) reaction.

j. This term means "the techniques that are used to measure enthalpy":

k. This term means "the energy needed to raise the temperature of an object 1^o C":

l. This term means "the energy needed to raise the temperature of one gram of a substance 1^o C":

m. The heat capacity is an extrinsic property. What does this mean?

4. Antacids: You are given 1.12 M HCl and 1.48 M NaOH. The antacid you use contains 300 mg of $CaCO_3$ and 100 mg of $Al(OH)_3$. If the antacid dissolved in 35.0 ml of HCl and was then back titrated with 21.8 ml of NaOH., find the following:

a. The mmoles of HCl used to dissolve the antacid

b. The mmoles of NaOH used to backtitrate

c. The mmoles of antacid used to neutralize the antacid (a.k.a. the excess HCl).

d. Write the balanced equations for the neutralization of the antacid (Both $CaCO_3$ and $Al(OH)_3$).

e. Using the number of mg in the tablet, calculate the mmoles of each component (Both $CaCO_3$ and $Al(OH)_3$).

f. Based on the mmoles of each component, calculate the theoretical number of mmoles of HCl that should have been needed to neutralize the antacid.

g. What was the total number of theoretical mmoles of HCl that should have been neturalized?

h. Compare the theoretical (g.) to the actual (c.). What are possible reasons this discrepancy could have occurred?

5. Spectrophotometry: Using a Spectrophotometer (Spec 20), a student recorded below the Percent Transmittance data for the following solutions:

Red Dye Standard (6.30 ppm)
Blue Dye Standard (5.05 ppm)
Purple Unknown

	400 nm	450 nm	500 nm	550 nm	600 nm	650 nm
Red Std	63.5	48.5	23.5	38.6	78.3	98.5
Blue Std	80.5	99.0	82.5	56.5	8.5	72.4
Purple Unk	79.3	72.5	35.5	85.8	45.5	65.3

a. Calculate the Absorbance for each of the %T listed above .

	400 nm	450 nm	500 nm	550 nm	600 nm	650 nm
Red Std						
Blue Std						
Purple Unk						

b. Determine the following from the data calculated in Part 1 (*2 pts*):

Red Dye Max. Absorbance = __________ at __________nm (λ Max)

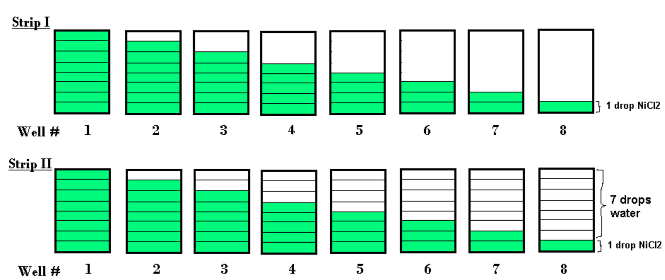
Blue Dye Max. Absorbance = __________ at __________nm (λ Max)

c. Calculate the Absorbance Ratio of the Unknown/Standard at (λ Max).

d. Calculate the Dye Concentration in the Unknown. *(Standard Concentrations given above.)*

	Abs of Unknown (at λ Max)	Abs of Standard (at λ Max)	Abs Ratio Unk/Std (at λ Max)	Dye Conc. in Unknown
Red in Purple				
Blue in Purple				

6. Colorimetry: Using the well strips below, the student put the following number of drops in the wells. In strip I, 1-8 drops of red dye standard solution (6.30 ppm) were added as shown in the diagram. In strip II, additional drops of water were added in order to have the same total volume of 8 drops for each well.



Given: The student found that the unknown solution of red dye matched well #5 on Strip II.

a. What is changing in the first well strip – concentration or pathlength?

b. What is changing in the second well strip – concentration or pathlength?

c. Looking from the top how does the intensity compare for Strip 1 to Strip 2?

more intense – the same – less intense

d. Using $C_1V_1 = C_2V_2$, what is the approximate concentration in ppm for the unknown?

7. Atomic Spectra: Using the Rydberg equation (where R = 3.29×10^{15} Hz) and the speed of light (C = 2.998×10^{8} m/s):

a. Calculate the expected frequencies in Hertz (s^{-1}) of the radiation emitted by a hydrogen atom for the following electronic transitions.

$$\nu = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

b. Calculate the expected wavelengths in nanometers (nm) of the radiation emitted by a hydrogen atom for the same electronic transitions.

$$\mathbf{C = \lambda \upsilon}$$

c. Label which wavelengths correspond to the Balmer series and which wavelengths correspond to the Lyman series.

Transitions	Frequency (s^{-1})	Wavelength (nm)	Balmer / Lyman
$n_2 = 3$ & $n_1 = 1$			
$n_2 = 2$ & $n_1 = 1$			
$n_2 = 5$ & $n_1 = 2$			
$n_2 = 4$ & $n_1 = 2$			
$n_2 = 3$ & $n_1 = 2$			

d. Why did the Hydrogen spectrum have the fewest lines?

e. For the Hydrogen spectra, why was the red line more intense (brighter) than the other lines?

8. Flame Tests – What color flame is produced by each of the following elements?

a. copper –
b. lithium –
c. potassium –
d. magnesium –
e. sodium –

f. Why did we need the copper wire for the Beilstein reaction?

9. **Gas Laws:** Using the ideal gas law calculate the volume of the system.

Given: pressure = 738 mmHg, mass = 0.725 grams, MW_{butane} = 58.000 g/mole, T = 20°C, R = 0.08206 Latm/molK

a. What is the number of moles of butane?

b. What is the pressure in atm?

c. What is the temperature in K?

d. What is the volume of the system?

e. What would the volume be at STP?

10.Gas Chromatography:

For peak A, the retention time is 120 mm, the baseline width is 60 mm, and the height is 30 mm. For peak B, the retention time is 200 mm, the baseline width is 40 mm, and the height is 30 mm.

a. For each peak, calculate the number of theoretical plates, N, where $\mathbf{N = 16 (t_R / w_b)^2}$.

P_A = P_B =

b. For each peak, calculate the area. This has been simplified to the equation for the area of a triangle, where **A = ½ (base)(height)**.

P_A = P_B =

c. How do you determine the efficiency of the systems? theoretical plates or Areas?

d. Which peak, corresponds to the most efficient elution through the column? P_A P_B

e. Using the peak areas, calculate the composition of (ratio of) the mixture A B.

f. How does the elution (travel time) change when you lengthen the column?

- for a gas with low interaction?
- for a gas with high interaction?

g. So what would changing the column length accomplish if the peaks were initially overlapping?

h. For the gas chromatography, we measured the retention time to the top of the peak. For the paper chromatography, we measured the retention time to the center of the dot. Why did we choose these points?

11. Statistics:

a. For the following data set (2.10, 3.20, 3.50, 4.90, 4.30, 2.90) find the mean (average).

b. For the average of the data set above, calculate the % Error if the expected answer was 3.500.

b. For this data set would you calculate the standard deviation or the standard deviation estimate? Explain why.

12. People – How did these people contribute to the experiments we did in Chem 2?

a. Galileo
b. Isaac Newton
c. Pierre and Marie Curie
d. Niels Bohr
e. Max Planck
f. Albert Einstein
g. Robert Bunsen
h. Gustav Kirchoff
i. Johann Balmer
j. Ernst Rutherford
k. Joseph von Fraunhoffer
l. Mikhail Tswett
m. Robert Boyle
n. Jacques-Alexandre Charles
p. Amedeo Avogadro
q. Joseph-Louis Gay-Lussac
r. John Dalton
s. Johannes Diderik van der Waals
t. My TA's name is…

13. Dimensional Analysis: Choose problems from sets 1, 2, 4 or 5 and work them.

14. Scientific Notation & Significant Figures:

a. Choose problems form sets 1 & 2 and work them.
b. Review problems from the midterm exam.

****Note:** Most of the questions on the final will be similar to those on review and on quizzes.